

# AIR FORCE PROGRAMS

## F-35 Joint Strike Fighter (JSF)

### SUMMARY

- The F-35 Joint Strike Fighter (JSF) meets all the Services' needs for a strike fighter aircraft with a family of common aircraft. The three variants of this aircraft are:
  - Conventional Takeoff and Landing
  - Aircraft Carrier Suitable
  - Short Takeoff and Vertical Landing (STOVL)
- JSF will be capable of striking and destroying a broad range of targets, day or night, in adverse weather conditions. These targets include fixed and mobile land targets, enemy surface units at sea, and air threats ashore and at sea including anti-ship and land attack cruise missiles.
- The program has spent the last year on efforts to reduce the aircraft weight and ensure the viability of the STOVL design.
- The impact of the loss of commonality between the three variants, resulting from the weight reduction efforts, will require an increase in the scope of the flight test effort and will require a revision to the current Test and Evaluation Master Plan (TEMP).



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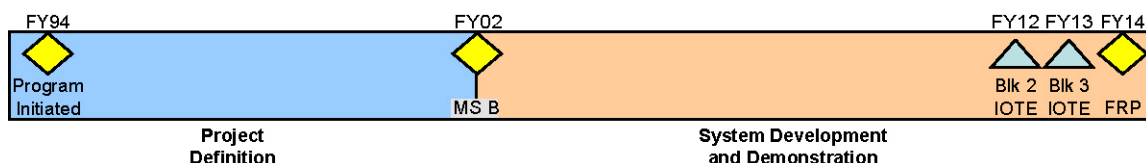
### SYSTEM DESCRIPTION AND MISSION

JSF is a joint, multi-national program for the U.S. Air Force, U.S. Navy, U.S. Marine Corps, and eight cooperative international partners: the United Kingdom, Italy, the Netherlands, Turkey, Canada, Australia, Denmark, and Norway. This family of strike aircraft will consist of three variants: conventional takeoff and landing; aircraft carrier suitable; and STOVL.

The System Development and Demonstration (SDD) phase is a block program to develop, acquire, and test the JSF in a series of upgrades. To accommodate the phased integration of capabilities and functionality, the Integrated Test Force and the operational test agencies will test interim blocks. As the SDD phase progresses, the users will develop requirements for additional capabilities for future block upgrades to respond to new threats.

Biennial operational assessments (OAs) will determine potential operational effectiveness and suitability with a focus on programmatic voids, areas of risk, testability of requirements, significant trends in development efforts, and the ultimate ability of the program to support an adequate period of evaluation during the dedicated operational test and evaluation of Blocks 2 and 3. OAs will not replace the independent period of dedicated operational testing necessary to support a full-rate production.

### TEST AND EVALUATION ACTIVITY



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The Air Force Operational Test and Evaluation Center and the Navy's Operational Test and Evaluation Force conducted an OA of JSF and issued a report on their findings in mid-2004. This OA was the first in a series of five planned during the SDD phase. Although a limited amount of new data were available because of the redesign efforts, the report found that the JSF program is making satisfactory progress toward being an effective and suitable system. However, the following areas require attention:

- The base and ship infrastructure were not designed for the JSF security-operating environment. The JSF Program Office (JPO) and the Services are working to mitigate impacts.
- The JSF concept of operations requires performance in very hot climates. The predicted air vehicle thermal output in this environment will cause significantly degraded performance.
- JSF users have a requirement for future growth in the areas of power, volume, and cooling. Future growth allocations are in jeopardy for all three areas. The initial design requires excess capability in order to meet future requirements.

Insight from Live Fire Test and Evaluation (LFT&E) tests conducted during FY04 is part of the design effort.

## TEST AND EVALUATION ASSESSMENT

This past year the JPO has focused on reducing the aircraft's vehicle weight. Aircraft weight is not a key performance parameter. However, weight reduction for the STOVL variant is critical to satisfy performance requirements. The Conventional Takeoff and Landing and Aircraft Carrier Suitable variants will benefit from weight reductions, but the current designs are low risk to satisfy key performance parameters. The JSF Program Office assesses that approximately 3,500 pounds of weight reduction is required for the STOVL variant in order to satisfy all key performance parameters. By the end of FY04, the JPO achieved approximately 2,700 pounds of weight savings/offsets through a three-step process.

- First, a STOVL variant weight attack team explored weight-savings design ideas. The most significant design change was a return to a thousand-pound weapon-capable bay.
- Second, the JPO made changes to the operating ground rules and assumptions for verifying requirements. These changes include reserve fuel requirements, ship landing patterns, and wave-off procedures.
- Third, the JPO conducted an analysis of requirements to determine where relief is prudent to balance warfighting needs and design realities. The most significant relief is a change to the mission profile to mirror that of the U.S. Navy's high altitude profile. Adopting the U. S. Navy profile permits the STOVL aircraft to satisfy the flat deck takeoff and range key performance parameters with a fuel weight 1,700 pounds less than the fuel capacity of the aircraft.

The STOVL weight reduction target of 3,500 pounds is optimistic.

- The JPO is utilizing a weight growth of three-percent during the SDD phase. DOT&E's weight threat assessment uses a six-percent growth value.
- DOT&E assesses there is an additional 800 to 1,000 pound threat to the STOVL design associated primarily with the difference in weight growth assumptions.
- Additionally, the cost to Force providers and warfighters of light-loading the STOVL aircraft with 1,700 pounds less fuel has yet to be determined.

DOT&E assesses the STOVL design is viable for the U.S. Air Force requirement for a short takeoff capability, but sees significant risk remaining in satisfying the U.S. Marine Corps shipboard operations requirements. The JPO must continue to reduce the weight of the STOVL design and should reassess their weight growth assumptions.

Another risk to the JSF program is the software development. The JSF requires an unprecedented amount of software. Block 3 delivers the majority of the capability. The slope of the learning curve and efficiencies required to execute Block 3 software development exceeds previous software development programs.

The scope of the flight test effort in the approved TEMP was acceptable when a high degree of commonality existed between the three variants. The weight reduction efforts have reduced the commonality between the variants - particularly in the area of weapons separation testing. The flight test program will have to grow to accommodate the new schedule and loss of commonality.